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Innovations in GBS Screening and Prophylaxis: Evaluating the Efficacy of Current and Emerging Methods. Mini-review

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Introduction

Group B Streptococcus (GBS) is a significant pathogen associated with early-onset neonatal infections, leading to severe complications such as sepsis, pneumonia, and meningitis [1, 2]. These infections can result in lifelong disabilities or death if not managed promptly and effectively [2]. Consequently, accurate screening and timely prophylaxis are crucial to mitigate the risks posed by GBS. Pregnant women, especially those who carry GBS, are often asymptomatic, making proactive screening essential to prevent vertical transmission during labor and delivery.

Current strategies for managing GBS focus on identifying carriers and administering intrapartum antibiotic prophylaxis (IAP) to reduce the likelihood of neonatal infection [3-7]. This review synthesizes findings from eight studies comparing the efficacy of various GBS screening methods, including antepartum cultures, intrapartum PCR assays, and risk-based screening approaches [8-15].

Additionally, GBS serotypes vary in pathogenic potential. For instance, serotypes III and V are more frequently associated with severe neonatal outcomes [16]. Incorporating serotyping into screening protocols could offer critical insights for epidemiological surveillance and outbreak management. This could help healthcare providers tailor prevention strategies more effectively, improving patient safety and infection control.

This review consolidates findings from diverse studies to compare the effectiveness of different GBS screening and prophylaxis strategies. Notably, three studies are based on a single Danish cohort, offering robust data to evaluate these methods in a consistent population. By synthesizing these insights, this review aims to provide a comprehensive understanding of how various approaches can enhance maternal and neonatal care through detection that is more accurate and better-targeted prophylactic measures.

Comparative Effectiveness of Screening Methods

Intrapartum PCR vs. Antepartum Culture

A study involving 902 Danish pregnant women compared intrapartum PCR testing with antepartum cultures for detecting GBS. Intrapartum PCR demonstrated higher specificity (97%) and sensitivity (83%) than antepartum cultures (91% specificity, 82% sensitivity). Moreover, PCR had a superior positive predictive value (PPV) of 78%, compared to 55% for antepartum cultures. These findings indicate that intrapartum PCR is more accurate for detecting true GBS carriers at delivery, minimizing false positives and reducing unnecessary antibiotic prophylaxis.

Risk-Based vs. Culture-Based Screening

In the same cohort, risk-based screening was compared to culture-based methods. Culture-based screening, which involves collecting rectovaginal swabs at 35–37 weeks of gestation, showed 78% sensitivity and 95% specificity. In contrast, risk-based screening, relying on maternal risk factors, had a much lower sensitivity (21%), highlighting its limitations in accurately identifying GBS carriers. Therefore, culture-based screening remains a more reliable method for guiding prophylaxis.

Combining Risk-Based Screening with PCR Testing

A combined approach using both risk-based screening and intrapartum PCR reduced the proportion of women receiving IAP from 12% to 4%. With PCR's high sensitivity (83%) and specificity (97%), this method optimized carrier identification, ensuring prophylactic antibiotics were administered only to those at risk.

Impact of PCR-Based Screening on Antibiotic Use

PCR-based screening significantly reduced IAP use compared to risk-based approaches. Specifically, antibiotic use decreased by two-thirds as PCR results, available within 50 minutes, enabled timely, targeted prophylaxis. Although no cases of early-onset GBS disease were reported, the reduction in antibiotic use suggests that PCR-based screening could streamline prophylaxis decisions.

Predictive Value and Utility of Additional Screening Methods

PCR and Vaginal GBS Load

The correlation between pre-labor and intrapartum GBS colonization was explored, with PCR detecting significant vaginal GBS loads. Intrapartum PCR had a high sensitivity (98%), outperforming pre-labor culture-based methods, supporting its utility in guiding prophylactic decisions.

Urinary GBS Colony-Forming Units (CFUs) as Predictors

One study examined the predictive value of urinary GBS CFUs at 35–37 weeks for vaginal GBS colonization at delivery. While urinary CFUs showed some correlation with higher vaginal GBS loads, overall sensitivity was low. Despite its limitations,

urinary GBS screening could serve as an additional marker when combined with PCR or culture-based methods.

Systematic Urine Screening and Intrapartum PCR

Beyond GBS detection from vaginal or rectal swabs, expanding testing to include other sample types, such as urine and blood, could significantly enhance infection prevention. Urine testing might help identify asymptomatic carriers during pregnancy, while blood tests in newborns could facilitate early detection of sepsis. This approach could improve outcomes for both mothers and infants. Combining systematic urine screening at 35–37 weeks with intrapartum PCR provided a more comprehensive GBS screening strategy. Although urine cultures alone had low sensitivity, combining them with PCR testing improved risk stratification, ensuring timely prophylaxis for high-risk women.

Detecting Serotypes and Expanding Sample Types in GBS Screening

Incorporating GBS serotyping into routine screening could enhance epidemiological surveillance and help track outbreaks. Certain serotypes, like III and V, are more often linked to severe neonatal outcomes, such as early-onset disease (EOGBS) in newborns. Serotyping provides critical insights into strain distribution, aiding in managing outbreaks effectively.

Additionally, expanding GBS detection methods to include alternative sample types, such as urine and blood, could broaden screening capabilities. Urine testing for asymptomatic pregnant women may improve risk assessments, while blood testing in newborns could enhance the early detection of sepsis, thereby improving neonatal care.

Conclusion

In conclusion, this review underscores the critical importance of advancing GBS screening and prophylaxis to improve neonatal outcomes and enhance maternal care. The findings indicate that the efficacy of GBS screening methods can vary significantly, highlighting the need for continued evaluation and optimization of current practices.

The comparison of intrapartum PCR testing and antepartum cultures reveals that intrapartum PCR offers superior accuracy in detecting GBS at delivery, with higher specificity and sensitivity. This method's ability to reduce false positives and unnecessary antibiotic use underscores its potential for improving prophylaxis strategies. By minimizing the proportion of women receiving IAP and focusing treatment on those at actual risk, PCR-based screening can lead to more targeted and effective management of GBS.

The review also highlights the limitations of risk-based screening compared to culture-based methods. With a significantly lower sensitivity, risk-based screening falls short in reliably identifying GBS carriers, thus emphasizing the continued relevance of culture-based approaches. The integration of risk-based screening with PCR testing has proven to be a promising strategy, optimizing the identification of GBS carriers and further reducing unnecessary antibiotic use.

Expanding GBS screening to include additional sample types, such as urine and blood, presents a valuable opportunity for enhancing infection prevention. Although current urinary GBS colony-forming units (CFUs) testing demonstrates limited sensitivity, it can serve as a supplementary marker when used in conjunction with PCR or culture-based methods. Systematic urine screening combined with intrapartum PCR offers a more holistic approach, potentially improving risk stratification and prophylactic measures for high-risk women.

Incorporating GBS serotyping into routine screening protocols could further refine epidemiological surveillance and outbreak management. Identifying specific serotypes, such as III and V, which are associated with more severe neonatal outcomes, can aid in tailoring prevention strategies and addressing emerging threats more effectively. The integration of serotyping into screening could provide critical insights into strain distribution and enhance overall infection control efforts.

The cost and practicality of GBS testing remain significant factors in the widespread implementation of effective screening strategies. Reducing the cost of testing and simplifying procedures could facilitate universal screening and improve adherence to testing protocols, ultimately benefiting both maternal and neonatal health.

Overall, this review highlights the need for continued research and refinement of GBS screening methods. The integration of advanced techniques such as PCR, serotyping, and expanded sample types promises to enhance the accuracy of detection and the efficacy of prophylaxis. By adopting these advancements and addressing practical considerations, healthcare providers can significantly improve the prevention of GBS-related infections, ensuring better outcomes for both mothers and their newborns.

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